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Legal issues related to the digital economy – artificial intelligence

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I. Context

1. The increased and expanding use of artificial intelligence (AI) is transforming the global economy. By one forecast, the global spend on AI is expected to increase from \$37.5 billion in 2019 to \$97.9 billion in 2023.¹ By another forecast, cited in the 2019 *Digital Economy Report* published by the United Nations Conference on Trade and Development, AI could generate additional global economic output of around \$13 trillion by 2030, contributing an additional 1.2 per cent to annual global growth in gross domestic product.² AI is transforming trade not just in terms of the products and services being traded, but also in terms of trade-related activities such as supply chain management, the marketing of goods and services (including via online platforms), and the forming and performing of contracts.

II. What is artificial intelligence?

2. The term “artificial intelligence” is used to refer both to the capability of a machine to exhibit or simulate intelligent human behaviour and a branch of computer science concerned with this capability.³ Only the first meaning is relevant in the trade context, where the term “AI systems” is often used.⁴ In this regard, it is important to acknowledge that the technology driving the capability of AI systems is still in its infancy and disagreement exists among computer scientists as to what constitutes the “intelligent” behaviour to be exhibited or simulated by these systems.

3. Nevertheless, several recent international and regional initiatives have sought to define the general contours of AI systems. For instance:⁵

(a) The recommendation on AI adopted by the Council of the Organization for Economic Co-operation and Development in 2019 (“OECD Recommendation”)⁶ defines an “AI system” as “a machine-based system that can, for a given set of human-defined objectives, make predictions, recommendations, or decisions influencing real or virtual environments”. The definition adds that AI systems are “designed to operate with varying levels of autonomy”;

(b) The Independent High Level Expert Group on Artificial Intelligence (AI HLEG) appointed by the European Commission defines “AI systems” as “software (and possibly also hardware) systems designed by humans that, given a complex goal, act in the physical or digital dimension by perceiving their environment

¹ IDC, “Worldwide Spending on Artificial Intelligence Systems Will Be Nearly \$98 Billion in 2023, According to New IDC Spending Guide”, 4 September 2019, available at <https://www.idc.com/getdoc.jsp?containerId=prUS45481219>.

² UNCTAD, *Digital Economy Report 2019: Value Creation and Capture: Implications for Developing Countries* (Geneva, 2019), p. 8, referring to International Telecommunication Union (ITU), “Assessing the Economic Impact of Artificial Intelligence”, Issue Paper, No.1 (Geneva, September 2018).

³ See John McCarthy, *What is Artificial Intelligence?*, revised, 12 November 2007, available at www-formal.stanford.edu/jmc/whatisai.pdf. This dual meaning is recognized by the International Organization for Standardization (ISO), which defines the term “artificial intelligence” to mean: (a) “an interdisciplinary field, usually regarded as a branch of computer science, dealing with models and systems for the performance of functions generally associated with human intelligence, such as reasoning and learning”; and (b) the “capability of a functional unit to perform functions that are generally associated with human intelligence such as reasoning and learning”: ISO, *Information Technology – Vocabulary*, ISO/IEC Standard No. 2382, 2015.

⁴ To this end, the proposal of the Government of Czechia to the fifty-first session of the Commission (New York, 25 June–13 July 2018) on legal aspects of smart contracts and artificial intelligence refers to “systems capable of solving problems and performing tasks by means of simulating intellectual processes”: A/CN.9/960, para. 8.

⁵ It is worth noting that an Ad Hoc Committee on Artificial Intelligence set up by the Council of Europe (CAHAI) is currently preparing a feasibility study on a legal framework for the development, design and application of AI, which may put forward a definition of AI.

⁶ OECD, Recommendation of the Council on Artificial Intelligence (2019), document C/MIN(2019)3/FINAL.

through data acquisition, interpreting the collected structured or unstructured data, reasoning on the knowledge, or processing the information, derived from this data and deciding the best action(s) to take to achieve the given goal”. It adds that “AI systems can either use symbolic rules or learn a numeric model, and they can also adapt their behaviour by analysing how the environment is affected by their previous actions”.⁷

4. Defined as such, AI systems resemble the kinds of automated systems that have been the subject of several texts of UNCITRAL and the International Institute for the Unification of Private Law (Unidroit) on commercial contracting adopted over the past 25 years. In this context, automated systems are generally understood to mean software systems that are programmed to perform pre-defined tasks, such as the negotiation and formation of contracts, without human involvement.⁸ However, the tasks referred to in the OECD recommendation (“predictions”, “recommendations”, “decisions”) and the processes referred to by the AI HLEG to perform those tasks (“perceiving”, “interpreting”, “reasoning”, “processing”) indicate that AI systems are more complex and capable than the kind of automated systems in use at the time that those texts were adopted.

5. Two features of legal significance have been put forward to distinguish AI systems from other automated systems. They are: (a) the use of algorithms, in particular “machine learning” techniques, to improve the performance of pre-defined tasks and to perform new tasks; and (b) the processing of large quantities of data from multiple sources (sometimes referred to as “big data”).⁹ Other features have been put forward – such as “complexity”, “autonomy”, “unpredictability”, “opacity” and “vulnerability” – although these features may be regarded either as a consequence of machine learning and big data, or as issues to be addressed through improved design and deployment. It is also suggested that a legal analysis of AI should avoid using loaded human analogies such as “learning” or “autonomy” which, further to the observation above (para. 2) regarding “intelligence”, are difficult to define in a machine context.

III. Actors

6. The OECD Recommendation defines AI actors as those who play an active role in the “AI system lifecycle”. This is defined to consist of four phases: (i) design, data and models; (ii) verification and validation; (iii) deployment; and (iv) operation and monitoring. The OECD Recommendation also refers to “stakeholders”, being other persons involved in or affected by an AI system, which includes AI actors.

7. Using the OECD Recommendation as a basis, the actors involved in an AI system may, for the purpose of legal analysis, be divided into four broad categories, namely:

⁷ Independent High-Level Expert Group on Artificial Intelligence, *Ethics Guidelines for Trustworthy AI* (2019), available at

https://ec.europa.eu/newsroom/dae/document.cfm?doc_id=60419, p. 36.

⁸ See, e.g., article 13(2)(b) of the UNCITRAL Model Law on Electronic Commerce (MLEC), article 12 of the United Nations Convention on the Use of Electronic Communications in International Contracts (ECC), and article 2.1.2 of the Unidroit Principles of International Commercial Contracts (2016).

⁹ Similarly, in a recent report to the United Nations Educational, Scientific and Cultural Organization (UNESCO), the World Commission on the Ethics of Scientific Knowledge and Technology noted that, while “the technology behind AI is a standard ICT: it is based on collecting/acquiring data, storing, processing and communicating it”, the “unique features of cognitive machines come from quantities, which are transformed into qualities”. These quantities refer to data, processing and machine-learning algorithms: UNESCO, *Preliminary study on the technical and legal aspects relating to the desirability of a standard-setting instrument on the ethics of artificial intelligence*, document 206 EX/42 (21 March 2019), available at <https://unesdoc.unesco.org/ark:/48223/pf0000367422>.

(a) *developer*: the person who is responsible for the AI system's theoretical high-level design, programming, training and verification, and interfacing and integration with external hardware, applications and data sources before deployment;

(b) *data provider*: the person who provides – or is responsible for providing – data to the system (i.e., the data needed to support training, deployment or operation);

(c) *deployer*: the person who deploys the system by integrating it into its operations (e.g., the goods and services that it supplies), including by setting up, managing, maintaining and supporting the supply of data and infrastructure necessary for the operation and monitoring of the AI system and its interaction with the supplied data once deployed;

(d) *operator*: the person who operates the system:

(i) in many cases, the operator will be the person who deploys the system;

(ii) in some cases, the operator may be the end user of AI-enabled goods or services (e.g., if the end user has some control over the operation of the goods or services);

(e) *affected person*: any other person¹⁰ affected by the operation of an AI system, including by interacting with the system (e.g., by providing data to the system) or being the end user of AI-enabled goods or services.

IV. Legal regimes

A. Introduction

8. Owing to its widespread use in many sectors of society, AI engages a wide range of laws, including laws dealing with data protection/privacy, human rights (including anti-discrimination), employment, and antitrust/competition. In the areas of private law that are more closely connected to trade, the disruptive effects of AI are felt more keenly in the operation of AI systems. This is not to say that legal issues will not arise earlier in the AI lifecycle; rather, it is questionable whether the development and deployment of AI raises legal issues that are significantly different from those raised by the development and deployment of other software systems.

9. In the trade context, a distinction may be drawn between the use of AI **in trade** – for example, through the supply of AI-enabled goods and services – and the use of AI **to trade** – for example, through the use of AI systems to manage supply chains (including inventory forecasting), to market goods and services (including via online platforms), and to enter into and perform contracts. While this distinction is not always clear-cut – for instance, the same system may be used as a product in trade and to support trading activities – it may nevertheless serve as a useful tool for analysing the legal issues related to the use of AI.

B. AI in trade

1. Contract law

10. Where AI is used in trade, a contractual relationship may exist between the person deploying the AI system and the person operating the system (e.g., a contract for the supply of AI-enabled goods) or between the person operating the AI system and an affected person (e.g., a utilization agreement for the supply of AI-enabled services). In both of these cases, machine learning and big data can present difficulties

¹⁰ Some actors involved in the AI system may be machines, as in the case of an AI system interacting with another AI system.

in applying existing contract law rules, particularly with regard to establishing the existence of breach of contract and establishing causation of harm.¹¹

11. Lack of information about the algorithm running an AI system and the data processed may make it difficult for a party claiming breach to establish a correlation between the inputs and outputs of the system (sometimes referred to as the “black box” problem). For instance, in the case of the utilization agreement, the difficulty may be in establishing whether the party providing the AI-enabled service has performed what it undertook to perform according to the terms of the agreement (e.g., to support a claim of system malfunction or defective programming).

12. Lack of information may also make it difficult for the party to establish that the breach was the cause of harm for the purposes of establishing contractual liability. For instance, in the case of the contract for the sale of AI-enabled goods, the difficulty may be in establishing whether damage or injury suffered was caused by the operation of the AI system itself, as opposed to the quality of the data processed by the AI system that is attributable to a third party (or indeed the party claiming breach).

13. These difficulties have the potential to shift the balance between contracting parties in the traditional sale context by putting the seller/supplier in a stronger position vis-à-vis the purchaser. Proposals have been put forward for rebalancing through education of the parties (e.g., the development of model contract provisions and good practice guides) or through the imposition of additional obligations on the operator of the AI system (e.g., by way of an emerging body of AI standards and principles to be superimposed on contracting parties).¹²

2. Tort law

14. Similar evidentiary difficulties regarding causation of harm to those discussed above in the context of contract law (para. 12) may arise in the context of tort law.¹³ These difficulties may be magnified by the multiplicity of actors involved in the development and operation of AI systems. The EU Expert Group on Liability and New Technologies has restated these difficulties in the following terms:

Hard as it is to prove that some hardware defect was the reason someone was injured, for example, it becomes very difficult to establish that the cause of harm was some flawed algorithm. [...] It is even harder if the algorithm suspected of causing harm has been developed or modified by some AI system fuelled by machine learning and deep learning techniques, on the basis of multiple external data collected since the start of its operation.¹⁴

It has been suggested that, while these difficulties may not be insurmountable, they may add to the cost and time of dispute resolution.¹⁵

15. Additional difficulties may arise where the allegedly tortious conduct is constituted by the output of the AI system itself.¹⁶ For instance, the output of an AI

¹¹ In its proposal to the fifty-first session of the Commission on legal aspects of smart contracts and artificial intelligence, the Government of Czechia referred to the “evidentiary vacuum” in enforcing contracts involving the provision of AI-assisted services: [A/CN.9/960](#), para. 8.

¹² See footnote 18 below.

¹³ See proposal of the Government Czechia to the fifty-first session of the Commission on legal aspects of smart contracts and artificial intelligence, [A/CN.9/960](#), para. 11. In common law jurisdictions, the unpredictability of a given AI system may also deny the existence of a duty of care in the first place.

¹⁴ Similar difficulties have recently been identified by the UN Secretary-General’s High-level Panel on Digital Cooperation: *The Age of Digital Interdependence*, June 2019, p. 25.

¹⁵ Lord Sales, *Algorithms, Artificial Intelligence and the Law*, Sir Henry Brooke Lecture delivered at the Freshfields Bruckhaus Deringer, London, 12 November 2019, available at [www.supremecourt.uk/docs/speech-191112.pdf](#), pp. 12–13.

¹⁶ Compare this to attribution of “loss”, as discussed by the EU Expert Group on Liability and New Technologies, which is a matter of causation: *Liability for Artificial Intelligence and other Emerging Digital Technologies*, 2019. The issue of attributability has also been raised in discussions within the World Intellectual Property Organization concerning inventions and other

system may constitute a false, misleading or defamatory statement, a breach of copyright or the disclosure of confidential information, in which case questions arise as to the person to whom the output of the AI system can be attributed. In the case that liability depends on the state of mind of the tortfeasor (i.e., fault-based liability), additional questions arise as to when that state of mind is to be assessed. Questions may also arise regarding the standard of conduct against which the tortfeasor is to be assessed for the purpose of applying tort law principles (e.g., the standard of reasonableness).¹⁷ In this regard, an emerging body of AI standards and principles may be relevant.¹⁸

16. Difficulties in applying existing tort law rules have the potential to disadvantage affected persons, who may suffer harm as a result of the operation of AI systems. In response, proposals have been put forward to establish new liability regimes to better balance the interests of the various actors involved in the use of AI systems. For instance, the Contract Guidelines on Utilization of AI published by the Ministry of Economy, Trade and Industry of Japan notes:

[M]any legal issues regarding the development and utilization of AI-based software, including how to deal with the relationship of rights and who bears liability that might arise in connection to that development and utilization, remain unclarified because these are new issues, and existing legislation is insufficient. In light of these circumstances, there is a pressing need to determine the relationship of rights, attribution of liability, and other similar matters that arise when parties execute contracts.¹⁹

17. One proposal is to subject the operation of AI systems to strict liability rules, similar to those which apply to defects under product liability regimes. Several reasons have been put forward for this approach: (i) it encourages actors engaged in dangerous activities to take necessary safeguards and to carry out those activities with utmost care; (ii) it places the costs of such activities on those who benefit the most from them; and (iii) it protects those actors who are potentially affected by such activities and compensates them adequately; in particular, it avoids the need for an affected person to seek compensation from multiple parties in proportion to their contribution to the harm.

18. Another proposal is to adapt the law and principles of agency to the relationship between the AI system and its operator. At the same time, it has been noted that differences in the law of agency between different jurisdictions may make it difficult to find harmonized solutions, particularly in the absence of agreed standards of

intellectual works produced using AI systems: see document WIPO/IP/AI/GE/19/INF/4.

¹⁷ As the EU Expert Group on Liability and New Technologies notes, “[e]merging digital technologies make it difficult to apply fault-based liability rules, due to the lack of well-established models of proper functioning of these technologies and the possibility of their developing as a result of learning without direct human control”: *Liability for Artificial Intelligence and other Emerging Digital Technologies*, 2019, p. 23.

¹⁸ The United Nations Secretary-General’s High-level Panel on Digital Cooperation has recommended that “[a]udits and certification schemes should monitor compliance of [AI] systems with engineering and ethical standards, which should be developed using multi-stakeholder and multilateral approaches”. The panel goes on to “call for enhanced digital cooperation with multiple stakeholders to think through the design and application of these standards and principles such as transparency and non-bias in autonomous intelligent systems in different social settings”. In this regard, the panel cites the Institute of Electrical and Electronics Engineers’ Global Initiative on Ethics of Autonomous and Intelligent Systems, which has developed a range of standards in the design of AI systems”: *The Age of Digital Interdependence*, June 2019. Other relevant initiatives include: (a) the OECD Recommendation, which establishes principles for the responsible stewardship of trustworthy AI; (b) the process within UNESCO to elaborate a standard-setting instrument in the field of AI ethics (see 40 C/Re. 37); and (c) the work of CAHAI under the auspices of the Council of Europe, which is exploring the possible incorporation of ethical principles into a legal framework for the development, design and application of AI.

¹⁹ Japan, Ministry of Economy, Trade and Industry, *Contract Guidelines on Utilization of AI and Data: AI Section* (June 2018), English translation available at www.meti.go.jp/press/2019/04/20190404001/20190404001-2.pdf, p. 1.

conduct (referred to in para. 15 above). As the EU Expert Group on Liability and New Technologies recently found:

The policy argument is quite convincing that using the assistance of a self-learning and autonomous machine should not be treated differently from employing a human auxiliary, if such assistance leads to harm of a third party ('principle of functional equivalence'). However, at least in those jurisdictions which consider vicarious liability a variant of fault liability, holding the principal liable for the wrongdoing of another, it may be challenging to identify the benchmark against which the operations of non-human helpers will be assessed in order to mirror the misconduct element of human auxiliaries.²⁰

19. Yet another proposal is to introduce a no-fault compensation scheme for accidents involving AI systems, backed by mandatory insurance and a fall-back public fund.²¹ While it is conceivable for such a scheme to be implemented for some AI systems such as AI-enabled goods distributed locally, additional challenges may be presented in relation to other AI systems, particularly AI-enabled services delivered online to global users.

20. Short of introducing new liability regimes, other proposals have been put forward to supplement existing tort law rules, including shifting the burden of proof in establishing tort claims, subjecting AI systems to an independent *ex ante* review,²² or by imposing new obligations of disclosure on the person deploying or operating an AI system.²³ In this regard, the OECD Recommendation promotes the principle of "transparency and explainability" and establishes certain minimum information requirements for AI actors. To date, while guided by the principle of transparency, UNCITRAL texts on electronic commerce have avoided imposing obligations of disclosure on the parties.²⁴

3. Product liability law

21. Many legal systems have special regimes for product liability. A question arises as to whether AI systems used in trade could engage liability under these regimes. For one, product liability laws may be restricted to goods and exclude services. Accordingly, while these regimes may apply to AI-enabled goods, they may not apply to AI-enabled services.²⁵ A related issue is that the laws may only cover certain types of harm (e.g., personal injury and property damage). Moreover, product liability laws may be limited to products for personal, family or household use. As such, these laws may be of limited applicability in the trade context.

22. Another issue is that product liability regimes assume that the product does not change over time. Most product liability regimes provide for an exception to liability in circumstances where the product was developed in accordance with the knowledge and technology at the time of production. Also, product liability laws usually exclude liability if the defect did not exist when the product was put into circulation. This may pose challenges in establishing liability for AI systems that run on machine learning algorithms.

²⁰ *Liability for Artificial Intelligence and other Emerging Digital Technologies*, 2019, p. 25.

²¹ See, e.g., European Parliament, Resolution of 16 February 2017 with Recommendations to the Commission on Civil Law Rules on Robotics (2015/2103(INL)).

²² As noted in footnote 18 above, the United Nations Secretary-General's High-level Panel on Digital Cooperation has recommended that "[a]udits and certification schemes should monitor compliance of [AI] systems with engineering and ethical standards, which should be developed using multi-stakeholder and multilateral approaches": *The Age of Digital Interdependence*, June 2019, recommendation 3C.

²³ See, e.g., key findings 22, 24, 26 and 27 of the Expert Group on Liability and New Technologies: *Liability for Artificial Intelligence and other Emerging Digital Technologies*, 2019, pp. 7–8.

²⁴ Article 7 of the ECC expressly preserves "any rule of law that may require the parties to disclose their identities, places of business or other information".

²⁵ In Australia, the product liability regime, set out in part 3–5 of the Australian Consumer Law (schedule 2 to the *Competition and Consumer Act 2010*), applies to "goods", a term which is defined in section 2(1) of the law to include "computer software".

C. AI to trade

23. The use of AI – and automation in general – to trade primarily raises issues of contract law.²⁶ In particular, novel issues may arise with respect to the negotiation, formation and performance of contracts, as well as their interpretation.

24. Some of these issues have so far been analysed through the prism of “smart contracts”. When originally coined, the term “smart contract” was conceived of as “a computerized transactions protocol that executes the terms of a contract” that was designed to “satisfy common contractual conditions”.²⁷ More recently, the International Telecommunication Union has defined “smart contract” to mean a “program written on the distributed ledger system which encodes the rules for specific types of distributed ledger system transactions in a way that can be validated, and triggered by specific conditions”.²⁸ In this sense, a smart contract is – at most – a program used to perform a contract in an automated manner or – at least – a program used to perform some transaction in an automated manner without any connection to a contract whatsoever.²⁹ Some legal commentary and legislation has employed the term – or the variant “smart legal contract” – to refer to a program (deployed in particular on a distributed ledger system) that embodies or performs a contract.³⁰ At the same time, other legal commentary has observed that the term “smart contract” is a misnomer so far as it refers to a program that is neither a “contract” nor “smart” (in the AI sense). To avoid the risk of confusion, and in keeping with the principle of technology neutrality, the Secretariat considers it preferable to leave aside the term “smart contract” and instead to refer to the use of AI and automated systems – however deployed – in the negotiation, formation and performance of contracts.

1. Negotiation and formation

25. One legal issue that has been raised is how to satisfy the requirement of intent of the parties when an automated system is used to “negotiate” and enter into a contract. Writing extrajudicially, one judge of the Supreme Court of the

²⁶ This is not to say that legal issues beyond contract law are unlikely to arise. For instance, a failure of a programmer correctly to translate the terms of a contract into code for automated performance may give rise to tort liability.

²⁷ Nick Szabo, “Smart Contracts”, 1994, available at www.fon.hum.uva.nl/rob/Courses/InformationInSpeech/CDROM/Literature/LOTwinterschool2006/szabo.best.vwh.net/smart.contracts.html.

²⁸ ITU, *Distributed Ledger Technology Terms and Definitions*, Technical Specification FG DLT D1.1, 1 August 2019, available at www.itu.int/en/ITU-T/focusgroups/dlt/Documents/d11.pdf, para. 6.51. See also ISO, *Blockchain and Distributed Ledger Technologies — Overview of and Interactions between Smart Contracts in Blockchain and Distributed Ledger Technology Systems*, ISO/TR 23455:2019, which defines a “smart contract” – without reference to contractual obligations – as a “computer program stored in a distributed ledger system wherein the outcome of any execution of the program is recorded on the distributed ledger”.

²⁹ The creator of *Ethereum* – the platform that has popularized smart contracts – has expressed regret in adopting the term “smart contracts”, adding that it should have been called “something more boring and technical” like “persistent scripts”: Allen Scott, “Vitalik Buterin: I Quite Regret Adopting the Term ‘Smart Contracts’ for Ethereum”, *Bitcoinist*, 14 October 2018, available at <https://bitcoinist.com/vitalik-buterin-ethereum-regret-smart-contracts/>.

³⁰ For instance, in Italy, Law Decree No 135/2018, enacted with modifications by Law No 12 of 11 February 2019 (available at www.gazzettaufficiale.it/eli/gu/2019/02/12/36/sg/pdf), which gives the same legal effect to a smart contract as a contract in written form once the parties have been identified in accordance with the procedure established by the Agency for Digital Italy, defines “smart contract” to mean “a computer program based on distributed ledger technologies whose execution is legally binding upon two or more parties with reference to the effects previously agreed by the same parties”. In Malta, the Malta Digital Innovation Authority Act, 2018 (MDIA Act) defines “smart contract”, which is an “innovative technology arrangement” within the remit of the Malta Digital Innovation Authority, as either a computer protocol, or “an agreement concluded wholly or partly in an electronic form which is automatable and enforceable by execution of computer code, although some parts may require human input and control and which may be also enforceable by ordinary legal methods or by a mixture of both”.

United Kingdom has queried the ability of English law to address this issue, observing:

If there is to be a contract drafted or adapted by machines, there will have to be significant development to our law of contract which will require careful and imaginative consideration. [...] Questions about the intention to enter into legal relations, to whom that intention is to be attributed and how the terms of a computer-generated contract are to be recorded to achieve legal validity and interpreted will require innovative thinking.³¹

26. Similar doubts have been expressed with respect to other legal systems.³² At the same time, a recent court decision in Singapore suggests that imputing intention on a person when using AI systems to contract can be addressed by applying existing principles. Specifically, in the case of *B2C2 Ltd. v. Quoine Pte. Ltd.*, the first instance judge made the following remarks with reference to algorithmic programs used to enter into trading contracts:

They are, in effect, mere machines carrying out actions which in another age would have been carried out by a suitably trained human. They are no different to a robot assembling a car rather than a worker on the factory floor or a kitchen blender relieving a cook of the manual act of mixing ingredients. All of these are machines operating as they have been programmed to operate once activated.

Where it is relevant to determine what the intention or knowledge was underlying the mode of operation of a particular machine, it is logical to have regard to the knowledge or intention of the operator or controller of the machine. In the case of the kitchen blender, this will be the person who put the ingredients in and caused it to work. His or her knowledge or intention will be contemporaneous with the operation of the machine. But in the case of robots or trading software in computers this will not be the case. The knowledge or intention cannot be that of the person who turns it on, it must be that of the person who was responsible for causing it to work in the way it did, in other words, the programmer. Necessarily this will have been done at a date earlier than the date on which the computer or robot carried out the acts in question.³³

27. On appeal, the Court of Appeal of Singapore agreed with this analysis³⁴ and made the following general remarks on the issue:

Algorithmic trading is an area of dynamic change, and it might be more appropriate for legislative intervention in due course, if it were thought that a more fundamental redesign of the applicable legal framework is called for. That is certainly not our view at this time and we consider that the existing body of law can be meaningfully adapted to deal with the situation at hand.³⁵

³¹ Lord Hodge, *The Potential and Perils of Financial Technology: Can the Law Adapt to Cope?*, Edinburgh FinTech Law Lecture delivered at the University of Edinburgh, 14 March 2019, available at www.supremecourt.uk/docs/speech-190314.pdf, pp. 12–13.

³² For Belgium, see Hervé Jacquemin and Jean-Benoît Hubin, “Aspects contractuels et de responsabilité civile en matière d’intelligence artificielle”, in *L’Intelligence Artificielle et le Droit*, Hervé Jacquemin and Alexandre de Streel, eds. (Brussels, Larcier, 2017), pp. 104–105.

³³ Singapore International Commercial Court, *B2C2 Ltd. v. Quoine Pte. Ltd.*, Suit No. 7 of 2017, Judgment, 14 March 2019, [2019] SGHC(I) 03, paras. 209–210. In the case of *Australian Competition and Consumer Commission v. Trivago N.V.*, it was uncontroversial that the output of algorithms “used” by Trivago to offer services were attributed to it for the purposes of applying consumer protection law: Federal Court of Australia, Case No. VID 1034 of 2018, Judgment, 20 January 2020, [2020] FCA 16.

³⁴ *Quoine Pte. Ltd. v. B2B2 Ltd.*, Civil Appeal No. 81 of 2019, Judgment, 24 February 2020, [2020] SGCA(I) 02, para. 97: “in cases where contracts are made by way of deterministic algorithms, any analysis concerning knowledge of a mistake or unconscionably taking advantage of one must be done by reference to the state of mind of the programmers of the algorithms at the time of the programming”.

³⁵ *Ibid.*, para. 79.

28. At the same time, the courts at both instances stressed that the algorithmic program at issue was “deterministic”, in the sense that it operated in a “pre-ordained manner”. This calls into question whether the same reasoning would apply to AI systems that run on machine learning algorithms.³⁶

29. To address the uncertainty as to attribution in the use of AI systems to contract, it has been proposed that a rule could be developed modelled on existing UNCITRAL texts that deal with automated systems.³⁷ In this regard, article 13(2)(b) of the UNCITRAL Model Law on Electronic Commerce (MLEC) deems a data message to be a data message of a person (the “originator”) if it was sent “by an information system programmed by, or on behalf of, the originator to operate automatically”. In other words, the rule attributes an action of a system (i.e., the sending of a data message) to a person (i.e., the person who programmed the system). Whether this rule extends to an AI system is discussed below (para. 37). A similar principle underlies article 12 of the United Nations Convention on the Use of Electronic Communications in International Contracts (ECC) concerning the use of “automated message systems” (discussed in paras. 38 and 39 below). While article 12 does not itself establish a rule of attribution (i.e., it does not identify who the parties are to a contract concluded using an automated message systems), the explanatory note on the ECC states that “[e]lectronic communications that are generated automatically by message systems or computers without direct human intervention should be regarded as originating from the legal entity on behalf of which the message system or computer is operated”.³⁸

30. Whether or not the rule in article 13(2)(b) of the MLEC applies to an AI system, it is clear that it does not deal with matters relating to state of mind (e.g., what the person to whom an act is attributed “knew” or “intended” and at what point in time). It is conceivable that the rule could be extended to these matters by, e.g.:

(a) Deeming the person who programmed or operated the AI system to have knowledge of information contained in data used by the AI system in taking the relevant action; or

(b) Deeming that person to have, at the time when the action was taken, the intention that the person had at the time the AI system was programmed or operated.

31. Another legal issue that has been raised is the validity and interpretation of a contract that is memorialized – in whole or in part – in code (i.e., the code of the program running an AI or automated system) to facilitate the automated performance of the contract. This might not be problematic for some legal systems in which the courts are accustomed to interpreting code in the context of software-related disputes.³⁹ Nevertheless, a question arises as to whether there is utility in developing a rule – similar to the rule that exists in article 5 MLEC – that gives legal recognition to contracts in the form of code that are not accessible to the court (in the sense of being readable or interpretable) without translation into natural language.

³⁶ For instance, referring to the first instance decision, Lord Sales of the Supreme Court of the United Kingdom, writing extrajudicially, has observed (footnote 15, p. 18) that “in future the programs may become so sophisticated and operate so independently that it may be that this process of looking back through them to the minds of those who created them will seem completely unreal”.

³⁷ See, e.g., Hervé Jacquemin and Jean-Benoît Hubin (footnote 32, pp. 109–110), who propose a presumption that the act of an AI system is attributed to the person who operates the system.

³⁸ *United Nations Convention on the Use of Electronic Communications in International Contracts* (United Nations publication, Sales No. E.07.V.2), para. 213.

³⁹ For a recent case involving the interpretation of algorithmic code, see *Australian Competition and Consumer Commission v. Trivago N.V.* (footnote 33). Separately, Lord Hodge has observed that the interpretation of contracts in the form of program code should not pose much difficulty under English or Scottish law. He notes (footnote 31, p. 11) that “[s]o long as the operation of the computer program can be explained to judges... it should be relatively straightforward to conclude that people who agree to use a program with smart contracts in their transactions have objectively agreed to the consequences of the operation of the “if-then” logic of the program”.

2. Performance

32. To the extent that an automated system is used to perform a contract (i.e., the original use case for “smart contracts”), an issue that has attracted some attention in legal commentary concerns the translation of the terms of a contract (or indeed regulatory requirements) into the code of the program that runs the AI or automated system. Particular attention has been drawn to “soft” concepts such as “reasonableness” and “good faith”, whose application ordinarily depend on the circumstances at the time of performance, which may not have been contemplated at the time that the code was written. It is questionable whether this issue raises any novel legal issues, particularly noting the longstanding use of automated systems to perform contracts (such as recurring payments from a bank account). At first glance, the translation of such concepts into code would appear to be primarily a coding issue that raises the question of whether the operation of the program as coded satisfies the terms of the contract (or regulatory requirements).

33. Another issue that has been raised, related to the use of automated systems to perform a contract, is remedies. The case commonly cited is that of a “smart contract” embedded in a distributed ledger system whose performance cannot be altered or stopped once deployed. It is conceivable that a court seized of a dispute in this case would have a range of remedies at its disposal from which to choose to best resolve the dispute and provide adequate relief for the injured party. Nevertheless, questions have been raised as to whether these remedies are sufficiently adapted to automated contracting, and whether a multilateral harmonized response in the form of a model law on technology-enabled automatic remedies is warranted.⁴⁰

D. Reflections for the Commission

34. As noted by the Secretariat in its note on legal issues related to the digital economy (A/CN.9/1012, para. 21), the use of AI to trade raises legal issues relating to the adequacy of existing legal rules on the use of AI – and automation more generally – in the negotiation, formation and performance of contracts. It is therefore proposed as part of the workplan put forward in that note that preparatory work should be undertaken by the Secretariat towards the development of harmonized rules on the use of AI and automation in contracting.

35. Conversely, the use of AI to trade raises legal issues relating to the adequacy of existing liability regimes that raise a number of complex public policy questions. In keeping with the emphasis of the Commission on “proposing solutions that address legal obstacles and take into account public policy considerations”,⁴¹ it is not proposed that preparatory work on the use of AI to trade should be undertaken at this stage but rather that the Secretariat should continue its exploratory work in this area with a particular focus on taking stock of the various public policy questions and possible legislative solutions with a view to supporting the Commission’s coordinating role in the area (A/CN.9/1012, para. 21).

V. Preliminary appraisal of relevant UNCITRAL texts

A. Electronic commerce texts

36. As already noted above (para. 29), UNCITRAL texts on electronic commerce contain provisions dealing with some legal aspects of automated systems that might apply to AI systems.

⁴⁰ See, e.g., Teresa Rodríguez de las Heras Ballell, “Legal Challenges of Artificial Intelligence: Modelling the Disruptive Features of Emerging Technologies and Assessing Their Possible Legal Impact”, *Uniform Law Review*, vol. 24 (2019), p. 314.

⁴¹ *Official Records of the General Assembly, Seventy-fourth Session, Supplement No. 17 (A/74/17)*, para. 210.

1. MLEC

37. As noted above (para. 29), article 13(2)(b) of the MLEC contains a deeming provision regarding the origination of data messages sent by an “information system” that is programmed to operate automatically. The term “information system” is defined to mean a “system for generating, sending, receiving, storing or otherwise processing data messages”. A question arises as to whether an AI system falls within the meaning of “information system”, and thus whether the rule of attribution in article 13(2)(b) applies to the output of AI systems in the form of data. It is relevant to note that the explanatory note on the ECC (discussed in paras. 38–39 below) states that an information system⁴² differs from an automated system in that the “primary use” of the latter is to “facilitate exchanges leading to contract formation”. This suggests that, as the use of a system is not part of the definition, an automated system would be an “information system” for the purposes of the MLEC. If, then, the term “information system” were to apply to an automated system, it could be extended to an AI system, applying the reasoning discussed below with respect to the ECC.

2. ECC

38. Article 12 of the ECC provides that a contract formed by the interaction of an “automated message system” and a natural person or another such system shall not be denied validity or enforceability on the sole ground that no natural person reviewed or intervened in each of the individual actions carried out by the automated message systems or the resulting contract. The Convention defines an automated message system in turn to mean “a computer program or an electronic or other automated means used to initiate an action or respond to data messages or performances in whole or in part, without review or intervention by a natural person each time an action is initiated or a response is generated by the system”. In essence, article 12 is a non-discrimination rule that is concerned with preserving the legal effect of contracts concluded using automated systems.

39. The explanatory note on the ECC states that an “automated message system” essentially refers to a system for automatic negotiation and conclusion of contracts without involvement of a person and that the critical element of the definition is the lack of a human actor. The explanatory note further states that, while article 12 is based on the “paradigm that an automated message system is capable of performing only within the technical structures of its preset programming” (i.e., in a deterministic manner), “at least in theory, it is conceivable that future generations of automated information systems may be created with the ability to act autonomously and not just automatically”. It goes on to refer to developments in AI that may enable a computer “to learn through experience, modify the instructions in its own programs and even devise new instructions”. The explanatory note would thus appear to indicate that, at the time of the negotiation of the ECC, UNCITRAL took the view that AI systems run on machine learning algorithms may fall within the meaning of “automated message system” even though their operation may be characterized as being “autonomous” rather than “automated”.⁴³

3. Summary

40. Even if the provisions on automated systems in existing electronic commerce texts apply to AI systems, those provisions only deal with limited legal aspects of the

⁴² The term “information system”, as defined in the MLEC, is also used in the ECC.

⁴³ A similar view was earlier expressed by the National Conference of Commissioners on Uniform State Laws of the United States in its commentary on the definition of “electronic agent” in the Uniform Electronic Transactions Act (1999), which states that, if developments in artificial intelligence occurred so as to enable autonomous capabilities, the “courts may construe the definition of electronic agent accordingly, in order to recognize such new capabilities”: National Conference of Commissioners on Uniform State Laws, *Uniform Electronic Transactions Act (1999) with Prefatory Note and Comments*, available at www.uniformlaws.org/HigherLogic/System/DownloadDocumentFile.ashx?DocumentFileKey=4f718047-e765-b9d8-6875-f7a225d629a8&forceDialog=0, p. 8.

use of such systems in the negotiation, formation and performance of contracts. For instance, the MLEC only deals with the attribution of the sending of data messages and not with other issues of attribution that might arise relating to the output of AI systems. For instance, as noted above (para. 30), it does not deal with matters relating to state of mind (e.g., what the person to whom an act is attributed “knew” or “intended” and at what point in time). Moreover, the ECC only deals with the formation of contracts using automated systems and not with the use of such systems throughout the contract lifecycle. As noted by the Secretariat in its note on legal issues related to the digital economy (A/CN.9/1012, para. 21), while not a comprehensive solution to the legal issues raised by the use of AI to trade, these texts provide a basis for developing harmonized rules on the use of AI and automation in contracting.

B. CISG

41. A preliminary issue that arises in relation to AI systems is whether an agreement to integrate an AI system into existing operations earlier in the AI lifecycle (whether for use in trade or to trade) or the supply of AI-enabled goods in trade towards the end of the AI lifecycle involves a contract for the sale of goods to which the United Nations Convention on Contracts for the International Sale of Goods (CISG) applies. In this regard, article 3(2) of the CISG excludes from its scope “contracts in which the preponderant part of the obligations of the party who furnishes the goods consists in the supply of labour or other services”. A question thus arises as to whether: (a) the contract involves the supply of services (in the case of AI-enabled goods, particularly relevant in this regard is the connectivity between the goods post-delivery and systems and data sources maintained or provided by the seller in order for the AI features of the goods to operate); and (b) whether that supply constitutes the preponderant part of the obligation of the seller.

42. With respect to (a), because AI is essentially software, the analysis of the supply of software under the CISG in addendum 2 (A/CN.9/1012/Add.2) is relevant. With respect to (b), according to case law on the CISG, the application of article 3(2) requires a comparison between the economic value of the obligations relating to the supply of labour and other services and the economic value of the obligations regarding the goods, as if two separate contracts had been made.⁴⁴ Thus, if the ongoing supply of services to support the AI features of the goods amounts to more than 50 per cent of the seller’s obligations, the CISG does not apply to the contract.⁴⁵ There is also case law indicating that a court should also take into account other factors than purely economic ones, including the circumstances surrounding the conclusion of the contract, the purpose of the contract and the interest of the parties in the various performances. In any event, article 3(2) requires a close analysis of the relevant contract on a case-by-case basis. In this regard, it should be acknowledged that, in practice, services to support AI features of goods may be supplied under a separate agreement (including by a third party).

43. Another issue that arises is whether a contract for the sale of goods that is formed using an AI or automated system is compatible with the provisions on contract formation in chapter II of the CISG. In this regard, article 11 of the CISG recognizes the principle of freedom of form for sales contracts, and thus supports their conclusion through the exchange of data messages (see also article 20(1) of the ECC) and does not appear to preclude the use of automated systems to form contracts.⁴⁶ At the same time, some provisions may not apply on their terms where AI and automated systems are used. For instance, article 14 provides that an offer is constituted by a proposal that is “addressed to one or more specific persons” provided that it is sufficiently definite and indicates “the intention of the offeror to be bound in case of acceptance”. A question thus arises whether a particular AI system deployed, such as the kinds of

⁴⁴ *UNCITRAL Digest of Case Law on the United Nations Convention on Contracts for the International Sale of Goods* (New York, 2016), p. 20.

⁴⁵ *Ibid.*

⁴⁶ See explanatory note on the ECC (footnote 38), para. 209.

algorithmic programmes deployed to form trading contracts using the platform considered by the courts of Singapore in the case of *B2C2 Ltd. v. Quoine Pte. Ltd.* (discussed in paras. 26 and 37 above), would satisfy the requirements of article 14, which in turn raises similar questions of attribution to those under general contract law that are discussed in section III above (paras. 25 to 30).

44. Yet a further issue that arises is the use of AI or automated systems in the performance of contracts within the scope of CISG. For instance, a question arises as to whether the remedies under the CISG for non-performance or partial-performance of the contract can be applied or are indeed sufficiently adapted. Similar questions also arise under general contract law (see para. 33 above).

45. Overall, it would appear that, while the CISG can be applied to contracts for the sale of goods that involve the use of AI systems both in trade and to trade, a range of issues relating the applicability of its provisions arise. With respect to the use of AI systems to trade, it is likely that many of these issues will be addressed in the preparatory work that is proposed with regard to the use of AI and automation in contracting (see para. 34 above). In the interests of commercial parties engaging in the international sale of goods, this preparatory work should take into account the application of the CISG.
